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have forty-nine species left, of which thirty are still living and nineteen are extinct" (p. 135). Though the number of the species has thus been almost doubled, and the presence of the cave-bear remains undoubted, it continues to be the fact that no trace of the hyena has been found in the forest-bed, and no suspicion exists as to his probable presence amongst the eliminated uncertain species.

It should be added, that no relic or indication of hyena was met with in the 'fourth bed' of Brixham Windmill-hill Cavern, believed to be the equivalent of the Kent's Hole breccia.

I am not unmindful of the fact that my evidence is negative only, and that raising a structure on it may be building on a sandy foundation. Nevertheless, it appears to me, as it did ten years ago, strong enough to bear the following inferences:—

1. That the hyena did not reach Britain until its last continental period.

2. That the men who made the paleolithic nodule-tools found in the oldest known deposit in Kent's Cavern arrived during the previous great submergence, or, what is more probable, — indeed, what alone seems possible, unless they were navigators, — during the first continental period. In short, I have little or no doubt that the earliest Devonians we have sighted were either of glacial, or, more probably, of pre-glacial age.

It cannot be necessary to add, that while the discovery of remains of hyena in the forest-bed of Cromer, or any other contemporary deposit, would be utterly fatal to my argument, it would leave intact all other evidence in support of the doctrine of British glacial or pre-glacial man.

Some of my friends accepted the foregoing inferences in 1873; while others, whose judgment I value, declined them. Since that date no adverse fact or thought has presented itself to me; but through the researches and discoveries of others in comparatively distant parts of our island, and especially in East Anglia, the belief in British pre-glacial man appears to have risen above the stage of ridicule, and to have a decided prospect of general scientific acceptance at no distant time.

I must, before closing, devote a few words to a class of workers who are 'more plague than profit.'

The exuberant enthusiasm of some would-be pioneers in the question of human antiquity results occasionally in supposed 'discoveries,' having an amusing side; and not unfrequently some of the pioneers, though utter strangers, are so good as to send me descriptions of their 'finds,' and of their views respecting them. The following case may be taken as a sample: in 1881 a gentleman of whom I had never heard wrote, stating that he was one of those who felt deeply interested in the antiquity of man, and that he had read all the books he could command on the subject. He was aware that it had been said by one paleontologist to be "unreasonable to suppose that man had lived during the eocene and miocene periods," but he had an indistinct recollection that another eminent man had somewhere said that "man had probably existed in England during a tropical

carboniferous flora and fauna." He then went on to say, "I have got that which I cannot but look upon as a fossil human skull. I have endeavored to examine it from every conceivable stand-point, and it seems to stand the test. The angles seem perfect; the contour, the same, but smaller in size than the average human head: but that, in my opinion, is only what should be expected, if we assume that man lived during the carboniferous period, in spite of what Herodotus says about the body of Orestes." Finally he requested to be allowed to send me the specimen. On its arrival, it proved, of course, to be merely a stone; and nothing but a strong 'unscientific use of the imagination' could lead any one to believe that it had ever been a skull, human or infrahuman.

It may be added, that a few years ago a gentleman brought me what he called, and believed to be, 'three human skulls, and as many elephants' teeth,' found from time to time during his researches in a limestone-quarry. They proved to be nothing more than six oddly-shaped lumps of Devonian limestone.

So far as Britain is concerned, cave-hunting is a science of Devonshire birth. The limestone-caverns of Oreston, near Plymouth, were examined with some care, in the interests of paleontology, as early as 1816, and subsequently as they were successively discovered. The two most famous caverns of the same county — one on the northern, the other on the southern, shore of Torbay — have been anthropological as well as paleontological studies, and, as we have seen, have had the lion's share in enlarging our estimate of human antiquity. The researches have, no doubt, absorbed a great amount of time and labor, and demanded the exercise of much care and patience; but they have been replete with interest of a high order, which would be greatly enhanced if I could feel sure that your time has not been wasted, nor your patience exhausted, in listening to this address respecting them.

## LETTERS TO THE EDITOR.

### Tree-growth.

THE 'influence of winds upon tree-growth,' causing the asymmetry to which Mr. Kennedy calls attention in *SCIENCE* for Oct. 5, is noticeable to a remarkable degree among conifers in the mountains of the western half of the United States. The stunted, ground-hugging evergreens, which advance a little way above the limit of ordinary timber-growth on lofty mountains, are pressed to the earth by the steady gales as much as by overbearing snows, if not more. Evidence of this is found in the fact, that, where a cleft or little hollow occurs at or in advance of timber-line, the trees will stand straight and shapely within it as high as its rim (although in such nooks the snows lie longest and most deeply), above which they will be deformed, or unable to grow at all. This bending of the trees, the whole skirt of a forest, away from the edge of a precipice, or on a hilltop over which the wind sucks through the funnel of a cañon, is so common as to be seen every day by one travelling through the Rockies or the Sierra Nevada. It is particularly true in the Sierra San Joan, where the radiation of the vast adjacent sage-plains produces an

extraordinary suction upward, toward the chilly crests of that lofty range. I remember noticing it nowhere more strongly than on the coast of Sonoma county, Cal., swept by a constant indraught from the Pacific.

This was the locality of my article in *Harper's magazine* for January, 1883, styled 'In a redwood logging-camp.' In that article (p. 194), after speaking of the stiff, erect trunks of the Sequoia, as seen inland, I say, "In windy places, like the exposed sea-front, all the boughs are twisted into a single plane landward, and great picturesqueness results." As you look at these trees from a distance, you cannot resist the impression (however quiet the sea and the air) that a furious gale is at that moment straining every branch to leeward, as a March day does the garments of pedestrians, or the flags of the shipping in a harbor. The seashore parks of Victoria or Vancouver, and of San Francisco, give other examples of this same appearance. A conspicuous instance of this same thing is to be seen in the Salinas valley, which extends for over a hundred miles southward from Monterey. There a high point of view shows that every tree and bush (save large clusters) in the whole valley leans toward the south-east (approximately), urged by the terrific wind that never ceases to rush up the long valley from the sea to the hills.

It is needless, however, to seek examples so far away. A line of evergreens along the Greenwich River, in eastern Connecticut, shows the asymmetry produced by wind very plainly; and the shore-trees all along Montauk Point, and the low islands on that coast, are bent away from the sea. On any ocean coast (or equally along the Great Lakes), on wide plains, or in any lofty mountain-range, according to my pretty wide observation in the United States, one might tell the course of the prevailing winds as accurately as fifty years of signal-service observation, by a glance at exposed trees, which, nurtured in steady gales, bend in age as their sapling twigs were inclined.

Snow is another factor to be considered in regarding the growth of trees in mountain regions. The flattened thickets of spruce just above timber-line, of the same species which, in sheltered spots no lower down, assumes an erect and lofty attitude, are matted close to the ground by long weight of snow, as well as bowed beneath fierce gales. Many and varied examples of its effect might be adduced; but I will refer to one only. On the road to the anthracite mine above Crested Butte, in the Elk Mountains of Colorado, you pass through a large grove of aspens, some eighteen inches or more in diameter, standing thickly on the hillside, at an elevation of about nine thousand feet. That region is famous for its deep snows, which might be inferred from the fact that every tree in this broad aspen-grove is bent far out of the vertical, many of them thirty or forty degrees, and all uniformly as to direction. The only explanation of this is the snow, which weights them down through so many months of the year. The sturdier trunks rise vertically in many cases, but their tops arch over almost in a semicircle; while the saplings are bowed nearly to the ground. In many parts of the mountains, great swaths lie open in the woods, and can never (or at least do not) become forested on account of snow-slides; while the opposition of wind and snow together are the only conceivable reasons why many bare plateaus are not tree-grown; that, for example, between the Lake Fork of the Gunnison and Cochetopa Creek.

ERNEST INGERSOLL.

New Haven, Oct. 10, 1883.

### Standard railroad time.

Though the subject of standard and uniform railway time has for some years been under consideration by various scientific and practical bodies, it does not appear in any way to have been exhausted, even in its main features. Besides, a certain bias has shown itself in favor of the adoption of a series of certain hourly meridians, and thus keeping Greenwich minutes and seconds, when contrasted with the practicability of a more simple proposition. There is also a feature in the discussion of the subject which bears to have more light thrown upon it; namely, what necessary connection there is between the railway companies' uniform time and the mean local time of the people, or the time necessarily used in all transactions of common life. Directly or by implication, certain time-reformers evidently aim at a standard time, which shall be alike binding on railway traffic as well as on the business community; and to this great error much of the complexity of the subject is to be attributed, and it has directly retarded the much-needed reform in the time-management of our roads.

We say all ordinary business everywhere must forever be conducted on local mean solar time, the slight difference between apparent and mean time having produced no inconvenience; and we may rightly ask the railway companies to give in their time-tables for public use everywhere and always, the mean local time of the departure and of the arrival of trains. It is the departure from this almost self-evident statement, and the substitution and mixing-up in the time-tables of times referred to various local standards, which has in no small measure contributed to the confusion and perplexity of the present system. The people at large do not care to know by what time-system any railroad manages its trains, any more than they care what the steam-pressure is, or what is the number of the locomotive. All the traveller is interested in is regularity and safety of travel: hence it was to be desired, that, whatever the standard or standards of time adopted, the companies would refrain from troubling him with a matter which only concerns their internal organization, or which is entirely administrative. We look upon the publication of the railway time-tables, by local time everywhere, as a *sine qua non* for the satisfactory settlement of the time question, so far as the public at large is concerned; and it would seem equally plain that the best system for the administration of railroads would be the adoption of a uniform time, this time to be known only to the managers and employees of the roads.

We are informed in *SCIENCE* of Oct. 12, that the solution of the problem of standard railway time is near at hand, and probably has already been consummated by the adoption of four or more regions, each having uniform minutes and seconds of Greenwich time, but the local hour of the middle meridian. To have come down from several dozen of distinct time-systems to a very few and uniform ones, except as to the hour, is certainly a step forward, and, so far, gratifying; but why not adopt Greenwich time, pure and simple, and have absolute uniformity? Probably this will be felt before long. The counting of twenty-four hours to the day, in the place of twice twelve, and the obliteration from time-tables of the obnoxious A.M. and P.M. numbers, would seem to be generally acknowledged as an improvement and simplification, and perhaps can best be dealt with by adopting it at once, accompanied by a simple explanatory statement.

C. A. SCHOTT.

Washington, Oct. 18, 1883.